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Abstract

This study examines the issue of technology acceptance in a multi-campus secondary college in Sydney, Australia. Seventy-five teachers across two campuses were surveyed as to their perceptions regarding technology acceptance. Regression analysis was used to compare the explanatory power of the perceived characteristics of innovating model (PCIM), and the technology acceptance model (TAM). Both models explained a substantial amount of variation in technology acceptance. However, our findings suggest that it is preferable to use the PCIM, rather than the TAM, to explain intention to use an information technology innovation. Implications for both future research and practice are discussed.

Keywords

acceptance, innovating, perceived, comparison, empirical, technology, information, explaining, characteristics, innovation, intention

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**EXPLAINING INTENTION TO USE AN INFORMATION TECHNOLOGY
INNOVATION: AN EMPIRICAL COMPARISON OF THE PERCEIVED
CHARACTERISTICS OF INNOVATING AND TECHNOLOGY ACCEPTANCE MODELS**

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ABSTRACT

This study examines the issue of technology acceptance in a multi-campus secondary college in Sydney, Australia. Seventy-five teachers across two campuses were surveyed regarding technology acceptance. Regression analysis was used to compare the explanatory power of the *perceived characteristics of innovating model (PCIM)*, and the *technology acceptance model (TAM)*. Both models explained a substantial amount of variation in technology acceptance. However, our findings indicate that it is preferable to use the PCIM, rather than the TAM, to explain intention to use an information technology innovation. Implications for both future research and practice are discussed.

INTRODUCTION

Over the last two decades considerable research has been conducted to provide insight into factors influencing adoption and use of new information technology (Davis 1989, 1993; Davis, Bagozzi, & Warshaw 1989; Adams, Nelson & Todd 1992, Taylor & Todd 1995a, 1995b; Warshaw & Davis 1985; Venkatesh 1999; Venkatesh & Davis 1996; Venkatesh & Morris 2000). Interest in understanding the factors that explain why information technology innovations are adopted and diffuse in organizations remains high as reflected by recent publications on this topic in this journal (Van Akkeren & Cavaye 1999; Jones, Hecker & Holland 2002; Carroll, Howard, Peck & Murphy 2003; Seyal & Rahman 2003) and other major journals in the discipline (Lee, Kozar & Larsen 2003; Teo, Wei & Benbasat 2003; Venkatesh, Morris, Davis & Davis 2003). Two models that look at adoption and have resulted in instruments to measure relevant factors at the individual level are the Technology Acceptance Model (TAM) developed by Davis (1989) and the Perceived

Characteristics of Innovating Model (PCIM) developed by Moore & Benbasat (1991). The TAM contains only two explanatory factors while the PCIM contains these two factors and five additional factors. It is a question of both academic and practical importance whether the more elaborate PCIM performs better than the more parsimonious TAM in explaining adoption of new information technology. The purpose of this paper is to present the results of an empirical comparison of these models ability to explain intention to use an information technology innovation. A brief review of the development of these two models and their instruments is also provided.

THE TECHNOLOGY ACCEPTANCE MODEL (TAM)

The *technology acceptance model* (TAM) was developed by Davis (1989). He drew on research from a wide variety of fields including diffusion of innovations, marketing, human-computer interaction and self-efficacy theory to investigate the causes underlying user adoption of information technology. According to Davis (1989, p.323) there existed a striking convergence among the wide range of theoretical perspectives supportive of a conceptual and empirical distinction between usefulness and ease of use. As a result, he focused on providing improved measures of *perceived usefulness* and *perceived ease of use*. Davis (1989, p.320) defined usefulness as “the degree to which a person believes that using a particular system would enhance his or her job performance” and ease of use as “the degree to which a person believes that using a particular system would be free from effort” (p.320).

Davis developed, refined, and streamlined the new measures in a multi-step process. The first step involved developing explicit definitions of the constructs following a theoretical analysis from a variety of perspectives regarding why usefulness and ease of use are hypothesized determinants of system use. Based on this analysis, 14 items were developed for each construct. To enhance content validity he had an interdisciplinary panel of experts categorize the items resulting in the retention of 10 items for each construct. These two 10-item measures were then tested for validity and reliability in a field study of 112 users and two systems (electronic mail and file editor). Cronbach’s (1951) alpha measure of internal consistency reliability for the two systems were 0.97 for perceived usefulness and 0.91 for perceived ease of use. Multitrait-multimethod analyses supported convergent and discriminant validity. Factor analysis supported the notion that each scale was measuring a unidimensional construct.

The results of the field study indicated the need for further streamlining of the scales resulting in the deletion of four items from each of the scales. The resulting 6-item scales were then subjected to further construct validation through a laboratory test involving 40 participants using two graphics applications (Chartmaster and Pendraw). Half of the participants worked through a series of tasks in Pendraw followed by another series in Chartmaster. The remaining participants completed the same tasks in reverse order. Following the tasks participants completed the 6-item scales and self-predicted future use of the applications. Cronbach’s alpha reliability for perceived usefulness was 0.98 and 0.94 for perceived ease of use. Convergent, discriminant, and factorial validity of the two 6-item scales were again supported, demonstrating that the “new scales exhibited excellent psychometric characteristics” (Davis 1989, p.333). Details of the items in the two 6-item scales are provided in Appendix A.

According to Davis (1989) one of the most significant findings in his study was the relative strength of the usefulness-usage relationship compared to the ease of use-usage relationship. “In both

studies, usefulness was significantly more strongly linked to usage than was ease of use. Examining the joint direct effect of the two variables on use in regression analyses, this difference was even more pronounced: the usefulness-usage relationship remained large, while the ease of use-usage relationship was diminished substantially” (p.333). Davis (1989 p.334) further stresses that this finding has important implications for designers who have tended to over emphasize ease of use and overlook usefulness.

Davis’ TAM instrument was replicated and validated by Adams, Nelson & Todd (1992) and has subsequently been used, in its original or modified forms, in numerous studies in a range of contexts. An extensive meta-analysis of TAM studies was undertaken by Lee et al. (2003).

THE PERCEIVED CHARACTERISTICS OF INNOVATING MODEL (PCIM)

The *perceived characteristics of innovating model* (PCIM) was developed by Moore and Benbasat (1991). It is based on the *diffusion on innovation* (DOI) theory developed by Rogers (1983, 1995) and incorporates the constructs from the TAM (Davis 1989).

Rogers (1983, 1995) defined five attributes or characteristics of innovations which influence an individual’s attitude towards an innovation during the adoption process. *Relative advantage* is the degree to which an innovation is perceived as better than its precursor. *Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters. *Complexity* is the degree to which an innovation is perceived as being difficult to use. *Trialability* is the degree to which an innovation may be experimented with before adoption. *Observability* is the degree to which the results of an innovation are observable to others (Moore & Benbasat 1991, p.195).

Moore and Benbasat (1991) developed an instrument to measure an individual’s perceptions concerning these attributes of an innovation. They renamed Rogers’ complexity construct as *ease of use*, consistent with Davis (1989). They also developed the *image* construct which was defined as “the degree to which use of an innovation is perceived to enhance one’s image or status in one’s social system” (Moore & Benbasat 1991, p.195). According to Moore and Benbasat (1991), Rogers included the essence of the image construct in his definition of relative advantage. However, research indicating that it was separate from relative advantage was strong enough for Moore and Benbasat (1991) to decide to measure it as a separate construct. Also, as a result of their instrument development process, Moore and Benbasat (1991) found that observability construct separated into two constructs: *result demonstrability* and *visibility*. Result demonstrability “concentrated on the tangibility of using the innovation, including their observability and communicability” (Moore & Benbasat 1991, p.203). Visibility, on the other hand, focused on the physical presence of the innovation in the organizational setting. Thus, the constructs measured by the Moore and Benbasat (1991) instrument were relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability.

It is important to note that Moore and Benbasat (1991)’s model, and related instrument, is based on user perceptions about using the innovation (i.e. innovating), which differs from Rogers’ (1983, 1995) model, which focuses on the user perceptions of the innovation itself. According to Moore and Benbasat (1991):

Innovations diffuse because of the cumulative decisions of individuals to adopt them. Thus, it is not the potential adopters’ perceptions of the innovation itself, but rather

their perceptions of using the innovation that are the key to whether the innovation diffuses (p.196).

The instrument was developed in three stages. During stage one, the items were created following an extensive literature review examining previously developed scales including the 12 items used by Davis (1989) to measure ease of use and usefulness. Stage two focused on establishing construct validity and involved four rounds of sorting by four different groups of expert judges. Once the construct validity had been established the PCIM instrument was tested using two pilot tests and a final field study. The result was a 38-item instrument comprising eight scales, which showed very good psychometric characteristics. The one area of concern was that Relative Advantage and Compatibility emerged as a single factor rather than as separate factors as had been expected (Moore & Benbasat 1991, p. 208).

Moore and Benbasat (1991) also developed a short form of their instrument consisting of 25 items by deleting 13 items which, for their sample, did not significantly reduce the Cronbach's (1951) alpha for any scale. This short form of the instrument was used in this study. Details of the items in the eight multi-item scales in the short form instrument are provided in Appendix B.

Moore and Benbasat (1991)'s PCIM instrument has also been used in numerous studies demonstrating reliability and validity in a range of contexts (Moore & Benbasat 1996; Miller, Kelly, & Harper 1997; Karahanna, Straub & Chervany 1999).

METHOD: AN EMPIRICAL COMPARISON OF THE TAM AND PCIM

The empirical component of this research involved gathering and analyzing data to compare the ability of the *technology acceptance model* (TAM) and the *perceived characteristics of innovating model* (PCIM) to explain intention to use an information technology innovation. In this study the innovation chosen is the use of the Internet/Web for teaching purposes. As the PCIM incorporates the TAM's constructs the empirical comparison will mainly investigate whether the additional constructs included in the PCIM significantly improve its explanatory power. The incorporation of the TAM's constructs within the PCIM also means that the necessary data to make a meaningful comparison of the two models can be obtained by administering the short form of Moore and Benbasat's (1991) PCIM instrument.

Instrument administration

A questionnaire completed in a controlled environment was used to administer the instrument. The sample surveyed consisted of teaching staff in a multi-campus NSW secondary college, who use the Internet/Web or who might intend to use the Internet/Web in future for teaching purposes. The unit of analysis in this study is the individual teacher. Previous studies of this kind (for instance Davis 1989, Adams et al. 1992;) indicated that the lowest correlation scores obtained using similar instruments are of the order of 0.30. Borg and Gall (1983) estimated that, for a correlation of 0.30 to be statistically significant at the 0.01 level, at least 47 participants are required. Therefore, after allowing for potential absentees and those unwilling to participate in this study, we required the participation of at least two campuses (40 teachers are employed at each campus). The total number of teaching staff in attendance at the participating campuses on the day that the survey was administered was 75. All questionnaires were completed and useable. This satisfied our sample size requirements, and eliminated concerns relating to non response bias.

All of the teachers that participated in the study indicated prior usage of the internet/web. Further, all of the participating teachers had attended an in-service relating to the use of the internet/web in teaching at the beginning of the school year approximately six months prior to the date that the survey was administered.

Demographic data for each participant was requested in the questionnaire including data on age, gender, education level, and main teaching area. The sample was balanced in terms of gender (51% female and 49% male). In the sample 80% had completed four years of university education; 5% had completed three years education at either university or teachers college; while 15% had completed five years of university education. There was a fairly even spread of ages amongst the six age categories used; 17% of the sample were less than 29 years of age; 15% were between 30 and 34; 16% were between 35 and 39; 17% were between 40 and 44; 27% were between 45 and 49; and 8% were over the age of 50. All nine of the key learning areas in NSW secondary schooling with 7% from Creative Arts; 16% from Mathematics; 11% from Science; 16% from English; 5% from Health Studies; 17% from Human Society and its Environment; 4% from Languages other than English; 3% from Vocational Education; and 17% from Technology and Science.

All teacher participants were volunteers and completed the questionnaire during staff meetings, with the cooperation of the campus Principals. Prior to conducting the research, research ethics approval was obtained from the NSW Department of Education Strategic Research Directorate, and the Macquarie University Ethics Review Committee (Human Research).

Prior to the administration of the survey teacher participants were given several minutes to read the covering letter explaining the nature and purpose of the research. This was followed by a short introduction to the research by one of the researchers who was available throughout the process for any questions or problems regarding the survey. When all teachers had completed the survey they were asked to seal the survey inside the envelope provided. Once this procedure was completed the researcher collected the envelopes, matching the number of envelopes collected with a head-count of teachers taken earlier.

DATA ANALYSIS

Measurement of variables

The independent variables were measured using the short form of the Moore and Benbasat (1991) instrument which was modified slightly for use in this study, based on discussions with the schools' Principals. The *voluntariness* construct was excluded because at this stage use of the Web by teachers for teaching purposes was voluntary. The *ease of use* construct was reduced from 4 items to 2 items. The *image* construct was reduced from 3 items to 2 items and the *results demonstrability* construct was reduced from 4 items to 2 items. The reductions in the number of items were to reduce repetitiveness, or seeming lack of relevance to use of the Internet/Web for teaching purposes. The exclusion of these items resulted in the reduction of number of items from 25 to 18. The items used are shown in Appendix C and cross-references to the TAM and PCIM are shown in Appendices A and B. Descriptive statistics for the variables from this sample are provided in Table 1 below. Note that because the PCIM incorporates the TAM the values for *ease of use* in the PCIM are the same as the values for *perceived ease of use* in the TAM (they are based on the same three questions) and the values for *relative advantage* in the PCIM are very similar to the values for *perceived usefulness* in the TAM (they share four questions).

The dependent variable, Intention to Use the Internet/Web for Teaching, was measured using a single question which appears as Item 19 in Appendix C. Using the internet/web for teaching may involve perceptions about several aspects of this activity including the use of the internet and the content available on the internet. In this study the specific features of using the internet for teaching are not examined individually. Empirical research has shown that questions about behavioural expectations provide an effective means of estimating future behaviour (Davis 1989; Warshaw & Davis, 1985).

<i>Variable</i>	App C Item Nos	N	Min	Max	Mean	SD
Independent variables: PCIM						
Relative Advantage	1,2,3,4,5	75	1	7	4.33	1.63
Compatibility	6,7,8	75	1	7	4.12	1.65
Image	9,10	75	1	7	3.14	1.76
Visibility	11,12	75	1	7	3.68	1.65
Ease of Use	13,14	75	1	7	4.37	1.78
Result Demonstrability	15,16	75	1	7	4.74	1.74
Trialability	17,18	75	1	7	5.00	1.61
Independent variables: TAM						
Perceived Usefulness	1,2,3,4	75	1	7	4.40	1.63
Perceived Ease of Use	13,14	75	1	7	4.37	1.78
Dependent variable: Intention to use the Internet/Web for Teaching	19	75	2	7	5.35	1.59

Table 1: Descriptive statistics

Analysis of validity and reliability

Factorial validity of the two TAM scales was confirmed by factor analyzing (principal components analysis with varimax rotation) the six items making up these two scales. Inspection of the results in Table 2 below show that the six items loaded cleanly on to two factors as expected. *Perceived usefulness* was by far the more important factor, with an eigenvalue of 4.8 and accounting for over 80% of the variation in the data set. The *perceived ease of use* factor accounted for less than 10% of the variation and had an eigenvalue of less than one.

Scale	Item No	F1	F2
Perceived usefulness	1	.749	.536
	2	.874	.364
	3	.849	.385
	4	.889	.363
Perceived ease of use	13	.477	.831
	14	.336	.916
% of Variance		80.5	9.6
Eigenvalue		4.8	.57

Table 2. Factor analysis of the TAM scales
(Principal component analysis with varimax rotation)

Factorial validity of the seven PCIM scales (excluding *voluntariness*) was confirmed by factor analyzing (principal components analysis with varimax rotation) the 18 items making up these seven scales. Inspection of the results in Table 3 below show that the 18 items loaded cleanly on to six factors. This was similar to the results in the original Moore and Benbasat (1991) study where *relative advantage* and *compatibility* also loaded on to a single factor. The combined relative advantage and compatibility factor was the most important, with an eigenvalue of 10.5 and accounting for 58.7% of the variation in the dataset. *Image*, *trialability*, and *ease of use* were all relatively important factors, having eigenvalues greater than one, whereas *visibility* and *result demonstrability* had eigenvalues of less than one.

Scale	Item No	F1	F2	F3	F4	F5	F6	F7
Relative advantage	1	.766	.174	.246	.370	.065	.105	.189
	2	.621	.244	.186	.305	.181	.144	.558
	3	.827	.097	.168	.231	.192	.037	.260
	4	.669	.156	.201	.269	.248	.175	.517
	5	.787	.185	.202	.236	.068	.211	.281
Compatibility	6	.814	-.002	.188	.267	.193	.092	-.038
	7	.899	.168	.190	.150	.124	.192	-.051
	8	.847	.207	.216	.134	.082	.224	.060
Image	9	.144	.946	.080	.015	.171	.066	.076
	10	.154	.966	.039	.005	.073	.026	.031
Visibility	11	.282	.429	-.016	.020	.673	.316	.260
	12	.152	.100	.116	.103	.953	.021	.009
Ease of use	13	.531	.019	.178	.733	.146	.146	.181
	14	.472	-.036	.253	.773	.044	.210	.065
Result demonstrability	15	.432	.081	.258	.405	.190	.670	.082
	16	.551	.178	.385	.232	.180	.535	.182
Trialability	17	.248	.064	.886	.116	.077	.012	.180
	18	.303	.054	.815	.201	.059	.242	-.070
% of Variance		58.7	11.7	6.1	5.8	3.4	2.7	2.2
Eigenvalue		10.5	2.1	1.1	1.0	.62	.48	.40

Table 3. Factor analysis of the PCIM scales
(Principal component analysis with varimax rotation)

Internal consistency reliability of the two TAM scales and seven PCIM scales was analyzed using Cronbach's (1951) alpha. Inspection of the results in Table 4 below show the alpha values for all scales to be well above Nunnally's (1978) benchmark of .70 and comparable with the values in the Moore and Benbasat (1991) and Davis (1989) studies.

	M & B 1991		This study	
PCIM scales	Items	Alpha	Items	Alpha
Relative Advantage	5	.90	5	.96
Compatibility	3	.86	3	.93
Ease of Use	4	.84	2	.92
Result Demonstrability	4	.79	2	.89
Image	3	.79	2	.96
Visibility	2	.83	2	.81
Trialability	2	.71	2	.83
	Davis 1989 (Study 2)		This study	
TAM scales	Items	Alpha	Items	Alpha
Perceived Usefulness	6	.98	4	.95
Perceived Ease of Use	6	.94	2	.92

Table 4. Internal consistency reliability of the multi-item scales

RESULTS

Regression analyses

The empirical comparison of the ability of the TAM and PCIM to explain intention to use an information technology innovation was undertaken using three stepwise multiple regression analyses, each with *intention to use the internet/web for teaching* as the dependent variable. The TAM variables, *perceived usefulness* and *perceived ease of use*, were analyzed in the first regression model. The PCIM variables, *relative advantage*, *compatibility*, *image*, *visibility*, *ease of use*, *result demonstrability* and *trialability*, were analyzed in the second regression model. All TAM and PCIM variables were analyzed together in the third regression model. No serious breaches of the assumptions of normality, linearity, homoscedasticity or independence of residuals were identified in any of the three models. Some variables in the third regression model were very highly correlated but those variables were not selected by the stepwise procedure. The results of these regression are summarized in Table 5 below.

INDEPENDENT VARIABLES	TAM		PCIM		TAM & PCIM	
	Beta	t <i>p</i> -value	Beta	t <i>p</i> -value	Beta	t <i>p</i> -value
Perceived Usefulness	.475	3.79 .000				
Perceived Ease of use	.309	2.47 .016				
Result Demonstrability			.508	4.55 .000	.508	4.55 .000

Compatibility			.326	2.92 .005	.326	2.92 .005
Variance explained (R²)	.547		.616		.616	
Adjusted R²	.535		.605		.605	
Significance of F p-value	.000		.000		.000	

Table 5: Results of stepwise regressions of TAM and PCIM independent variables on dependent variable Intention to Use the Web for Teaching

Inspection of the first regression model in Table 5 shows that the model was significant, and that both the TAM variables were selected by the stepwise procedure. They both had positively signed coefficients and together explained 54.7% of the variation in the dependent variable. *Perceived usefulness* was selected to enter the model first and explained 50.9% of the variation and *perceived ease of use* explained an additional 3.8%. These two variables are correlated ($r = .77$) and when perceived ease of use was forced to enter first it explained 45.7% and perceived usefulness explained an additional 9.1%.

Inspection of the second regression model in Table 5 shows that the model was significant, but only two of the PCIM variables were selected by the stepwise procedure. They both had positively signed coefficients and together explained 61.6% of the variation in the dependent variable. *Result demonstrability* was selected to enter the model first and explained 57.0% of the variation and *compatibility* explained an additional 4.6%. These two variables are correlated ($r = .76$) and when compatibility was forced to enter first it explained 50.5% and result demonstrability explained an additional 11.1%. The third model was identical to the second model.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The TAM variables, *perceived usefulness* and *perceived ease of use*, performed well, together explaining 54.7% of the variation in *intention to use the web for teaching* in our sample of teachers. These two variables were correlated, with perceived usefulness showing slightly better explanatory power than perceived ease of use.

Of the seven PCIM variables *result demonstrability* and *compatibility* had the best explanatory power, together explaining 61.6% of the variation in *intention to use the web for teaching* in our sample of teachers. This was substantially better than the two TAM variables. These two variables were correlated, with result demonstrability showing slightly better explanatory power than compatibility. None of the other five PCIM variables had significant explanatory power over and above that provided by result demonstrability and compatibility. This is interesting because two of these five variables which did not provide additional explanatory power are the TAM variables which are incorporated in the PCIM (*ease of use* is identical to *perceived ease of use* and *relative advantage* is almost identical to *perceived usefulness* [$r = .995$]). In other words, although perceived usefulness and perceived ease of use had significant explanatory power when used on their own, there were other variables (result demonstrability and compatibility) that provided better explanatory power in this situation.

These results may be context specific to school teachers and their intended use of the internet/web for teaching, and may even be specific to our sample of teachers. Nevertheless, the two PCIM

variables explained over 10% more of the variation in intention to use the internet/web for teaching than did the two TAM variables.

Our findings lead to the conclusion that it is preferable to use the PCIM, rather than the TAM, to investigate intention to use an information technology innovation. This is because the PCIM incorporates the TAM variables (ease of use is identical to perceived ease of use and relative advantage is almost identical to perceived usefulness) and also offers five additional variables (compatibility, image, visibility, result demonstrability, and trialability), based on diffusion of innovation theory (Rogers 1983, 1995). These additional variables can perform better than the TAM variables in some situations, of which this study of teachers' intended use of the internet/web is one example.

LIMITATIONS AND FUTURE DIRECTIONS

The survey method was utilised in our investigation of the relationships between seven innovation adoption variables and intention to use the Internet/Web by teachers for teaching purposes. Data was collected through the use of a self-administered questionnaire. This method of data collection provided several advantages including the utilisation of an existing valid and reliable survey instrument and the ability to collect data in an efficient manner. While the method did provide several advantages, the limitations of the method should not be overlooked. First, the method relies on participants providing as veridical a response as possible to the researchers' questions. Also, as was the case in this study, the research then calls for examining the relationships between two or more of these self-reported pieces of evidence. Kline, Sulsky, and Rever-Moriyama (2000) point out that this approach raises concern that in addition to the "true" relationship expressed by the calculated correlation coefficient, some of the correlation coefficient is actually measuring a "spurious" relationship. The utilisation of this type of research design and analysis introduces a potential source of bias referred to as common method variance, where responses to one question may affect the response to another question.

Another limitation of this investigation is that the survey was cross-sectional in nature, and from only two schools at a single point in time. As such, there is the potential for the confounding effects of any exogenous factors outside the variables under investigation to distort the results. Future studies may utilize a longitudinal survey design, which was not possible due to the time constraints of this particular investigation. A further limitation of this study is the potential for systematic measurement error through either social desirability or demand characteristics (Singleton & Straits 1999). Future studies should utilise a multitrait-multimethod approach (Kline et al. 2000).

The current study did not make use of the demographic data as part of the regression analysis. Future studies could use various demographic variables such as access to technology, computer proficiency, level of IT training, general Internet/Web use for non-school purposes and other factors to see if it is possible to explain more of the variance in the data concerning Internet/Web adoption in learning and teaching. Future studies may also be designed to capture a very large state-wide sample to examine the effects of the demographic factors. Teachers at schools in remote or difficult socio-economic areas may respond differently. A future study could incorporate longitudinal design, combined with some qualitative methodology. For example, the introduction of a new Internet/Web technology into a school district could be examined at various stages throughout the implementation process in order to ascertain the stability or otherwise of teacher perceptions regarding the innovation attributes examined in this research.

Our findings have implications for educational administrators and researchers involved in designing, developing or implementing Internet/Web-based learning and teaching programs. This study shows that the TAM and PCIM provide meaningful explanations of teachers' intentions of using the Internet/Web for teaching in schools. Future studies could examine the applicability of the TAM and PCIM instruments in predicting the adoption of other technology innovations in learning and teaching.

REFERENCES

- Adams, D.A., Nelson, R.R. and Todd, P.A. (1992) 'Perceived Usefulness, Ease of Use, and Usage of Information Technology: A Replication'. *MIS Quarterly*, 16(2), 227-247.
- Borg, W.R. and Gall, M.D. (1983) *Educational Research: An Introduction*, 4th Edition, New York, Longmans.
- Carroll, J., Howard, S. Peck, J. and Murphy, J. (2003) 'From Adoption to Use: The Process of Appropriating a Mobile Phone'. *Australian Journal of Information Systems*, 10(2), 38-48.
- Cronbach, L.J. (1951) 'Coefficient Alpha and the Internal Structure of Tests', *Psychometrika*, 16, 297-334.
- Davis, F.D. (1989) 'Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology'. *MIS Quarterly*, 13(3), 319-340.
- Davis, F.D. (1993) 'User Acceptance of Information Technology: System Characteristics, User Perceptions and Behavioral Impacts'. *International Journal of Man-Machine Studies*, 38(3), 475-487.
- Davis, F.D., Bagozzi, R.P. and Warshaw, P.R. (1989) 'User Acceptance of Computer Technology: A Comparison of Two Theoretical Models'. *Management Science*, 35(8), 982-1002.
- Jones, C., Hecker, R. and Holland, P. (2002) 'Small Firm Internet Adoption: A Market Oriented Approach'. *Australian Journal of Information Systems*, 10(1), 99-109.
- Karahanna, E., Straub, D.W. and Chervany, N.L. (1999) 'Information Technology Adoption Across Time: A Cross-Sectional Comparison of Pre-Adoption and Post-Adoption Beliefs'. *MIS Quarterly*, 23(2), 183-213.
- Kline, T.J.B., Sulsky, L.M., and Rever-Moriyama, S.D. 2002. Common method variance and specification errors: A practical approach to detection. *Journal of Psychology*, 134, 401-421.
- Lee, Y, Kozar, K.A. and Larsen, K.R. (2003) 'The Technology Acceptance Model: Past, Present, and Future'. *Communications of the Association for Information Systems*, 12(50), 752-780.
- Miller, M.D., Kelly, R.K. and Harper, J. (1997) 'The Unidimensionality, Validity, and Reliability of Moore and Benbasat's Relative Advantage and Compatibility Scales', *Journal of Computer Information Systems*, Fall, 38-46.
- Moore, G.C. and Benbasat, I. (1991) 'Development of an Instrument to Measure the Perceptions of Adopting and Information Technology Innovation'. *Information Systems Research*, 2(3), 192-222.

- Moore, G.C. and Benbasat, I. (1996) 'Integrating Diffusion of Innovations and Theory of Reasoned Action Models to Predict Utilization of Information Technology by End-Users', in *Diffusion and Adoption of Information Technology*, Kautz, K. & Pries-Hege, J. (eds.), London, Chapman and Hall.
- Nunnally, J.C. (1978) *Psychometric Theory*, 2nd Edition, New York, McGraw-Hill.
- Rogers, E.M. (1983) *Diffusion of Innovations*, 3rd Edition, New York, Free Press.
- Rogers, E.M. (1995) *Diffusion of Innovations*, 4th Edition, New York, Free Press.
- Seyal, A. H. and Rahman, M.N. (2003) 'Student Use of the Internet: An Extension of TAM in Technical and Vocational Institutions in Brunei Darussalam'. *Australian Journal of Information Systems*, 10(2), 91-104.
- Singleton, R. A. and Straits, B. C. 1999. *Approaches to Social Research* (3rd ed.). Oxford University Press, New York, USA.
- Taylor, S. and Todd, P.A. (1995a) 'Assessing IT Usage: The Role of Prior Experience'. *MIS Quarterly*, 19(4), 561-570.
- Taylor, S. and Todd, P.A. (1995b) 'Understanding Information Technology Usage: A Test of Competing Models'. *Information Systems Research*, 6(2), 144-176.
- Teo, H.H., Wei, K.K. and Benbasat, I. (2003) 'Predicting Intention to Adopt Interorganizational Linkages: An Institutional Perspective'. *MIS Quarterly*, 27(1), 19-49.
- Van Akkeren, J.K. and Cavaye, A.L. (1999) 'Confusion with Diffusion? Unravelling IS Diffusion and Innovation Literature with a Focus on SMEs'. *Australian Journal of Information Systems*, 7(1), 60-67.
- Venkatesh, V. (1999) 'Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation'. *MIS Quarterly*, 23(2), 239-260.
- Venkatesh, V. and Davis, F.D. (1996) 'A Model of the Antecedents of Perceived Ease of Use: Development and Test', *Decision Sciences*, 27(3), 451-481.
- Venkatesh, V. and Morris, M.G. (2000) 'Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and their Role in Technology Acceptance and Behavior', *MIS Quarterly*, 24(1), 115-139.
- Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003) 'User Acceptance of Information Technology: Toward a Unified View', *MIS Quarterly*, 27(3), 425-478.
- Warshaw, P.R. and Davis, F.D. (1985) 'Disentangling Behavioral Intention and Behavioral Expectation', *Journal of Experimental Social Psychology*, 21, 213-228.

APPENDIX A

TECHNOLOGY ACCEPTANCE MODEL SCALE ITEMS (DAVIS 1989)

PERCEIVED USEFULNESS

1. Work more quickly (Item 1 in Appendix C)
2. Improve job performance (Item 2 in Appendix C)
3. Increase productivity (no item in Appendix C)
4. Enhance effectiveness (Item 4 in Appendix C)
5. Makes job easier (Item 3 in Appendix C)
6. Useful in my job (no item in Appendix C)

PERCEIVED EASE OF USE

1. Easy to learn (Item 14 in Appendix C)
2. Controllable (no item in Appendix C)
3. Clear and understandable (no item in Appendix C)
4. Flexible (no item in Appendix C)
5. Easy to become skillful (no item in Appendix C)
6. Easy to use (Item 13 in Appendix C)

APPENDIX B

PERCEIVED CHARACTERISTICS OF INNOVATING SCALE ITEMS

(MODIFIED SHORT FORM) (MOORE & BENBASAT 1991)

RELATIVE ADVANTAGE

1. Work more quickly (Item 1 in Appendix C)
2. Improves quality of work (Item 2 in Appendix C)
3. Makes job easier (Item 3 in Appendix C)
4. Enhance effectiveness (Item 4 in Appendix C)
5. Control over work (Item 5 in Appendix C)

COMPATIBILITY

1. Compatible with my work (Item 6 in Appendix C)
2. Fits well with way I like to work (Item 8 in Appendix C)
3. Fits into my work style (Item 7 in Appendix C)

IMAGE

1. Greater prestige (Item 9 in Appendix C)
2. Higher profile (no item in Appendix C)
3. Status symbol (Item 10 in Appendix C)

VISIBILITY

1. Commonly seen (Item 12 in Appendix C)
2. Visible (Item 11 in Appendix C)

EASE OF USE

1. Clear and understandable (no item in Appendix C)
2. Controllable (no item in Appendix C)
3. Easy to use (Item 13 in Appendix C)
4. Easy to learn (Item 14 in Appendix C)

RESULTS DEMONSTRABILITY

1. No difficulty telling others of results (Item 15 in Appendix C)
2. Communicate consequences to others (no item in Appendix C)
3. Results are apparent to me (Item 16 in Appendix C)
4. No difficulty explaining if beneficial (no item in Appendix C)

TRIALABILITY

1. Able to properly try it out (Item 17 in Appendix C)
2. Permitted to use it on trial basis (Item 18 in Appendix C)

APPENDIX C**QUESTIONNAIRE REGARDING USING THE INTERNET/WEB IN TEACHING**

Please keep the following definition in mind when completing this section.

The **Internet/Web** for **TEACHING** refers to your (teacher) use of the Internet/Web inside and outside the classroom to assist with your preparation and delivery of learning content. **For example**, use of the Web for researching units of work, your electronic communication (eg. via email, cyber forums) with other teachers regarding teaching activities, or your use of unit Web pages as a medium for delivering the content of your lessons.

I expect that using the **Internet/Web** for **TEACHING** preparation and delivery activities will:

- 1 Enable me to accomplish my tasks more quickly.
 - 2 Improve the quality of work I do.
 - 3 Make it easier to do my job.
 - 4 Enhance the effectiveness of my teaching.
 - 5 Give me greater control over my work.
 - 6 Be compatible with all aspects of my work.
 - 7 Fit into my work style.
 - 8 Fit well with the way I like to work.
 - 9 Provide me with greater prestige at school.
 - 10 Provide a status symbol at my school.
 - 11 Be very visible at my school.
 - 12 Be common in many classrooms in my school.
 - 13 Be easy to use.
 - 14 Be easy to learn.
4. I would have no difficulty telling others about the results of using the Internet/Web for **TEACHING** purposes.
 5. The results of using the Internet/Web for **TEACHING** purposes are apparent to me.
 6. Before deciding whether to use the Internet/Web for **TEACHING** purposes I would have the opportunity to properly try it out.
 7. I would be permitted to use the Internet/Web for **TEACHING** purposes on a trial basis long enough to see what it could do.
 8. I plan to use the Internet/Web for **TEACHING** purposes in the future.

(Editors note: Responses to the above statements are measured on a 7 point scale,
1 - strongly disagree to 7 - strongly agree)

